A Model of High-Resolution Winds in the Santa Barbara Channel, California

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LONG-TERM GOALS

To develop a high-resolution model of winds and ocean currents in the vicinity of Santa Barbara Channel (SBC) by combining basic understanding of the circulation processes through theory and observations, numerical techniques and data assimilation.

OBJECTIVES

In this Year 2, we have completed a three-month high-resolution simulation of winds in the channel and have conducted a detailed model/observation comparison.

APPROACH

We have configured the Navy's Coupled Ocean/Atmosphere Mesoscale Prediction System (COAMPS; Hodur, 1997) over the U.S. west coast, focusing on the Santa Barbara Channel (SBC; Figure 1). Although as shown in Figure 1 the model has a quadruple nesting capability, we have for the present study used triple nesting (81km:27km:9km). The outer-most nest is driven by the Navy's global atmospheric model, NOGAPS, on a relatively coarse grid ($1^o \times 1^o$). COAMPS solves the fully compressible, non-hydrostatic equations on Arakawa C-grid, uses the height-based terrain following vertical coordinate grid, has comprehensive radiation and cloud and precipitation physics, and has an option of using the Mellor-Yamada turbulence scheme. COAMPS also uses MVOI (multivariate optimum interpolation) analysis to map the observations to its grid. We have conducted testing (please see last year's report) that indicate that COAMPS is better suited for fine-scale coastal modeling than the popular MM5 (5th generation NCAR/Penn State mesoscale atmospheric model).

WORK COMPLETED

A three-month simulation, Mar/Apr/May of 1999, has been successfully completed. Extensive comparisons with observations have been conducted and model dynamics have also been analyzed. Results will be presented in the upcoming AGU Fall Meeting in San Francisco.

RESULTS

Examples are given in Figures 2 through 4. Figure 2 shows a typical scenario of wind and wind curl for spring and early summer, showing intense wind and wind curl over the western SBC. Figure 3 compares the 3-month mean winds and variances at six NDBC locations. While the model reproduces the observed 'speed-up' of wind as the latter 'turns around' the corner into the channel, as well as the deceleration further

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14. ABSTRACT
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15. SUBJECT TERMS

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east, the turning is somewhat less than that observed. This indicates that higher resolution may be required to simulate the observed sharper turning. On the other hand, the energy is simulated well (lower panel, Figure 3). Figure 4 gives more detailed time-series comparison at the same six locations.

IMPACT/APPLICATIONS

Small-scale wind fields play an important role in the SBC (Oey, 2000). We are encouraged by the COAMPS simulation in that it appears to have reproduced the correct intensity of the wind energy. The veering of the wind in the channel needs to be improved, and higher-resolution tests are required. We plan to use the COAMPS wind to drive the ocean model that we have developed in previous years (Oey, 1996, 1999; Oey et al. 2001, 2002).

RELATED PROJECTS

The research is in part supported by a grant from The Mineral Management Service (Contract # DOI-10094286; Program Manager: David Brown) via Scripps Institute of Oceanography, so that we work closely with Clinton Winant and Ed Dever (SIO) on observational data aspect, and also with Dong-Ping Wang (SUNY), on modeling and data-assimilation aspects.

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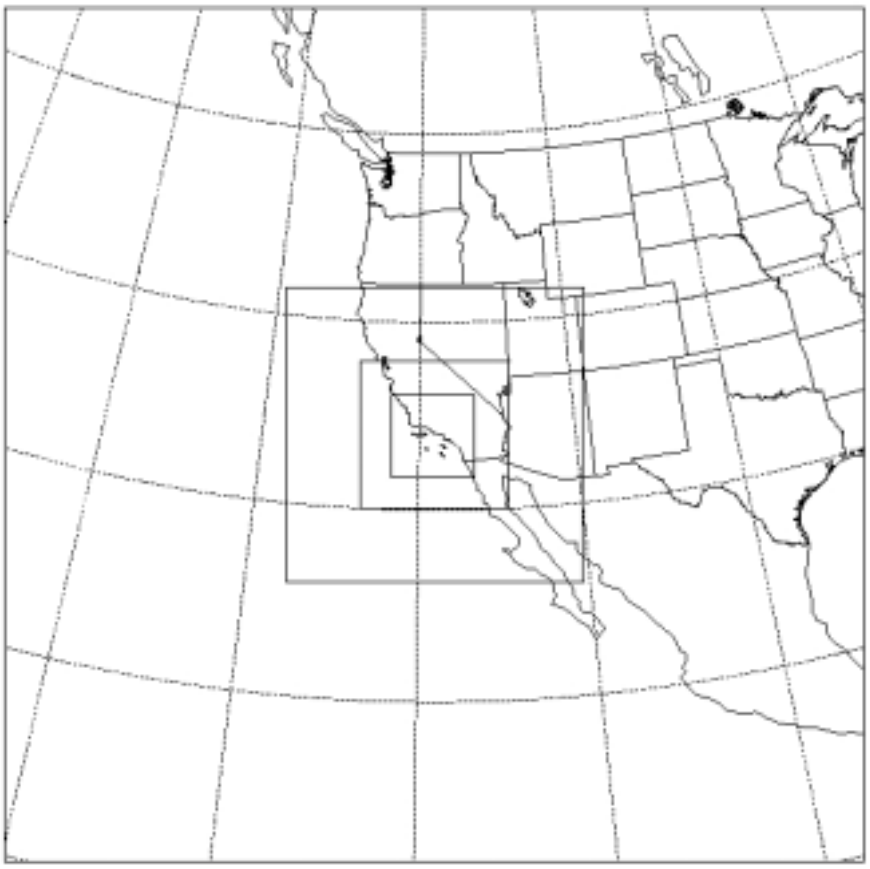

Figure 1 The quadruple nests (81km:27km:9km:3km) used by COAMPS centered over the Santa Barbara Channel. The inner-most nest is not used in this study.

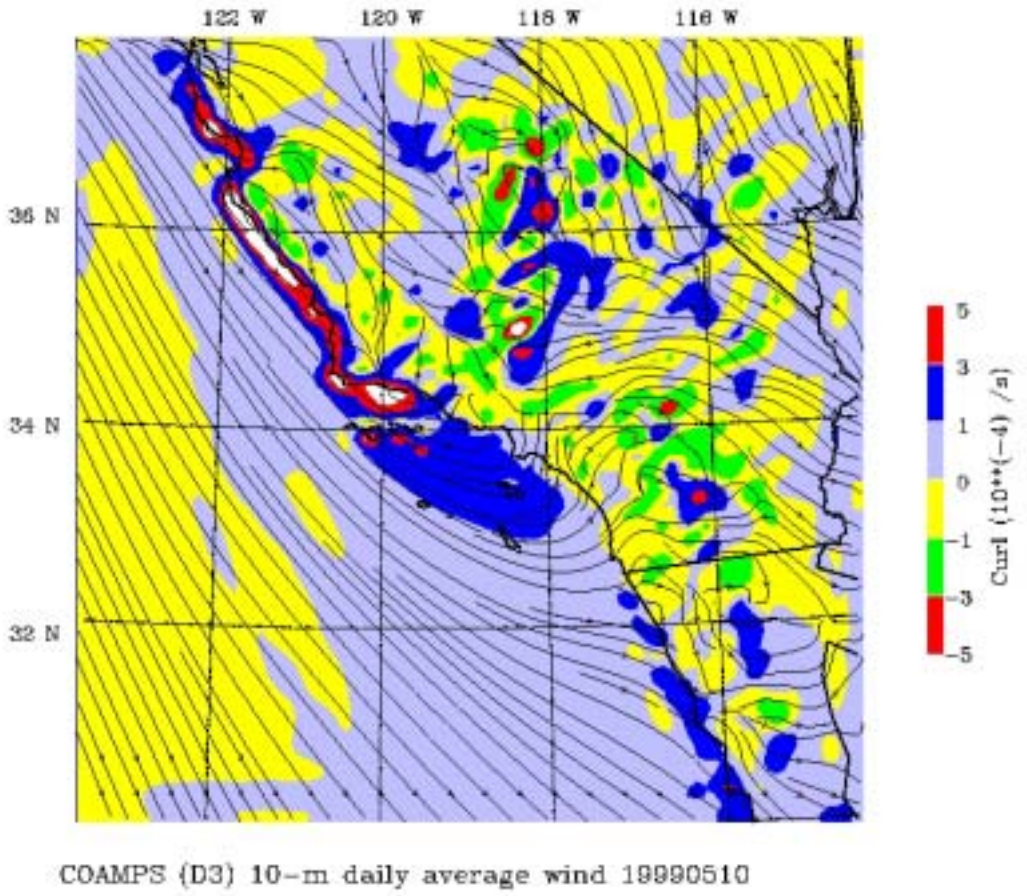

Figure 2 An example of the modeled wind at 10m and the corresponding wind curl on May/10th 1999, taken from the inner-most nest (9km resolution) of the COAMPS simulation. This shows a typical wind scenario in spring/summer when wind and wind curl are intense at the western portion of the Santa Barbara Channel, and weaken east and south of the channel.

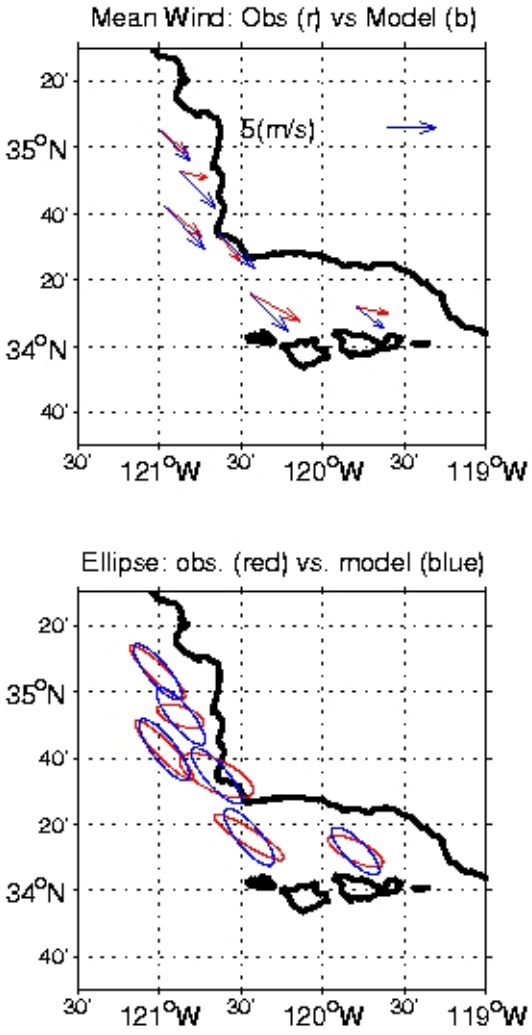

Figure 3 A comparison of the modeled wind at 10m with NDBC wind at six locations in the vicinity of the Santa Barbara Channel: 3-month (Mar/Apr/May/1999) means (upper panel) and corresponding variance ellipses (lower panel). The six locations are, from north to south and east: 46062, 11, 23, PTGC1, 54 and 53.

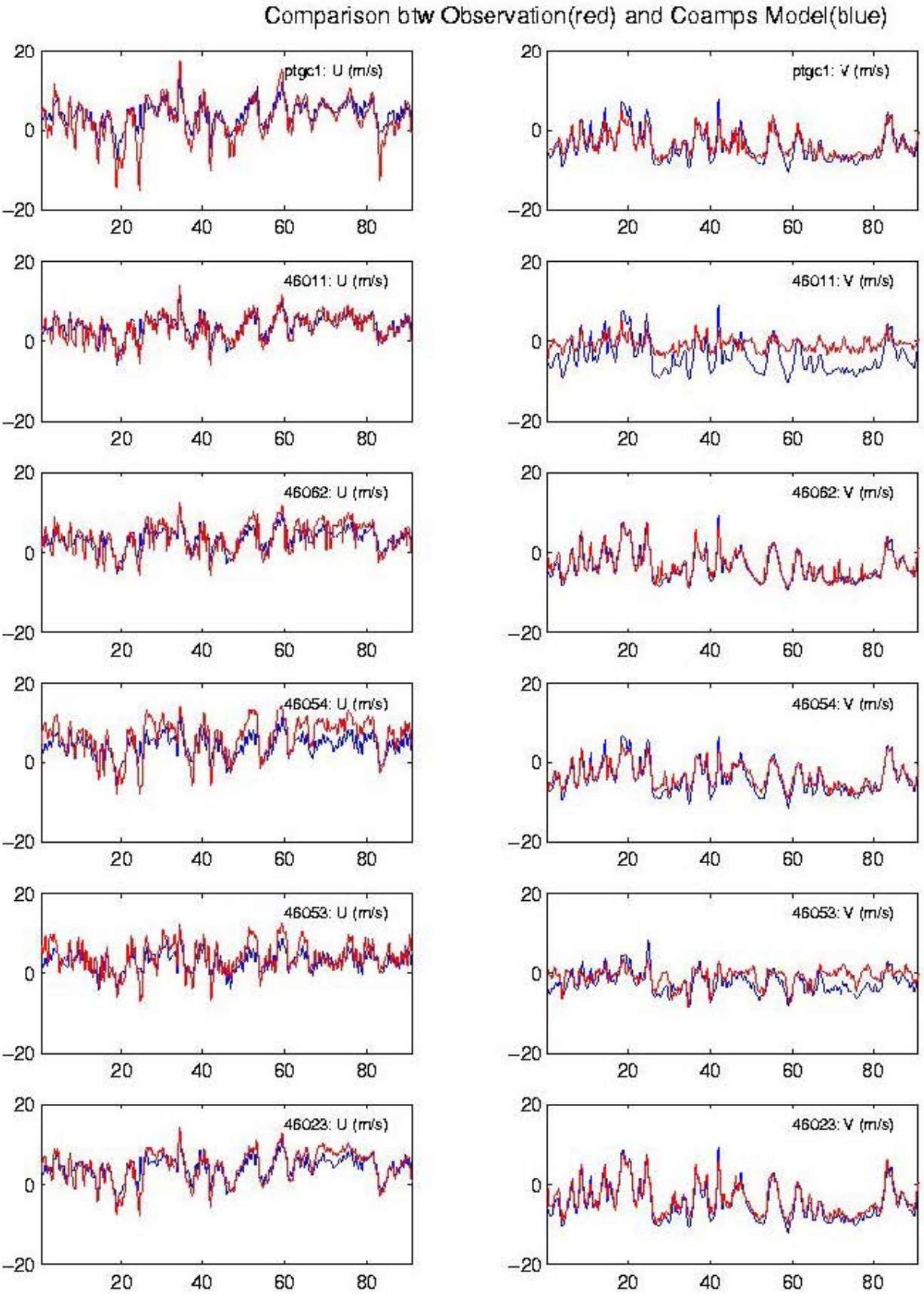

Figure 4 A comparison of the modeled wind time-series at 10m with NDBC wind at six locations in the vicinity of the Santa Barbara Channel (see Figure 3). Left panels are for east/west and right panels for north/south components.